UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/680,291	10/06/2000	Alexander P. Moravsky	7000R	9193

7590 03/08/2005

LEOPOLD PRESSER
SCULLY SCOTT MURPHY & PRESSER
400 GARDEN CITY PLAZA
GARDEN CITY, NY 11530-0299

EXAMINER	
ZIMMERMAN, GLENN	
ART UNIT	PAPER NUMBER
2879	

DATE MAILED: 03/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/680,291	MORAVSKY ET AL.	
	Examiner	Art Unit	
	Glenn Zimmerman	2879	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12/13/2004 & 5/7/2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-96* is/are pending in the application.

4a) Of the above claim(s) *1-66* is/are withdrawn from consideration.

5)☒ Claim(s) *67* is/are allowed.

6)☒ Claim(s) *68,69,71,72,80, 81 and 85-96* is/are rejected.

7)☒ Claim(s) *70,73-79 and 82-89* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *06 October 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *5/7/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Amendment, filed on December 13, 2004, has been entered and acknowledged by the examiner.

Claim Objections

Claims 85-89 are objected to because of the following informalities: In claim 85 line 4, the examiner suggests changing "the surface" to - - the cathode surface - -. In claim 85 line 4, the examiner suggests changing "element" to - - elements - -.

Claims 86-89 are objected to for depending from an objected base claim

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 88,89 and 96 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 88 recites the limitation "the fluorescent light emitting element" in lines 1 and 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 96 recites the limitation "the catalyst mixture" in line 2. There is insufficient antecedent basis for this limitation in the claim.

A 112 2nd paragraph rejection has been determined for claim 88, as written about above. However, a further evaluation of the claim will be done while interpreting "the fluorescent light emitting element" in line 88 as "fluorescent light emitting elements are".

Claim 89 is rejected for depending from a rejected base claim.

A 112 2nd paragraph rejection has been determined for claim 96, as written about above. However, a further evaluation of the claim will be done while interpreting "the catalyst mixture" in line 89 as "a mixture of the catalyst".

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 68, 69, 71, 72, 80, 81 and 90-96 are rejected under 35 U.S.C. 102(a) as being anticipated by Smalley et al. WO 00/17102.

Regarding claim 68, Smalley et al. disclose an electron-emissive material **(page 16 lines 11 and 22-23)** comprising a surface consisting primarily of a plurality of emissive tubules wherein each of the plurality of emissive tubules is generally

nanotubes with a controlled number of graphene layers consisting essentially of two layers of carbon atoms **(page 13 lines 20-21; and page 18 line 15)**.

Regarding claim 69, Smalley et al. disclose the electron-emissive material of claim 68, wherein the number of grapheme layers is two **(page 13 lines 20-21; and page 18 line 15)**.

Regarding claim 71, Smalley et al. disclose the electron-emissive material of claim 69, wherein an overall compositionof the electron-emissive material comprises at least 20% double walled nanotubes **(page 13 lines 20-21; and page 18 line 15)**.

Regarding claim 72, Smalley et al. disclose the electron-emissive material of claim 69, wherein an overall composition of the electron-emissive material comprises at least 70% of double walled nanotubes **(page 13 lines 20-21; and page 18 line 15)**.

Regarding claim 80, Smalley et al. disclose the electron-emissive materials of claim 69, wherein the double wall nanotubes have a length greater than 1000 nm **(col. 7 lines 22-26 choose to make them greater than 1000nm)**.

Regarding claim 81, Smalley et al. disclose the electron-emissive material of claim 69, wherein a plurality of the double wall nanotubes are oriented to cause electric field enhancement **(page 16 lines 11 and 22-23; page 13 lines 20-21; and page 18 line 15)**. The examiner believes that the wording electric field enhancement is relative, and is therefore met however they are oriented.

Regarding claim 90, Smalley et al. disclose fullerene material predominantly comprised of double walled carbon nanotubes **(page 13 lines 20-21; and page 18 line 15)** produced by the method providing a source of carbon and a catalyst comprised

essentially of transition metal of the iron group of the periodic table of the elements and sulfur, in a reaction zone having a DWNT forming atmosphere comprised essentially of hydrogen containing gas, subjecting the carbon and catalyst to heat in the reaction zone thereby to product hot carbon containing vapor quenching the hot vapor in the DWNT forming atmosphere thus condensing the hot vapor, collecting the resulting product and recovering the DWNTs from the resulting product outside the heated region of the reaction chamber.

The examiner notes that the preceding claim contains a product-by-process limitation(s) and the particular process by the method providing a source of carbon and a catalyst comprised essentially of transition metal of the iron group of the periodic table of the elements and sulfur, in a reaction zone having a DWNT forming atmosphere comprised essentially of hydrogen containing gas, subjecting the carbon and catalyst to heat in the reaction zone thereby to product hot carbon containing vapor quenching the hot vapor in the DWNT forming atmosphere thus condensing the hot vapor, collecting the resulting product and recovering the DWNTs from the resulting product outside the heated region of the reaction chamber has not been given patentable weight.

Regarding claim 91, Smalley et al. disclose the fullerene material predominantly comprised of double walled carbon nanotubes **(page 13 lines 20-21; and page 18 line 15)** according to claim 90 wherein the DWNT forming atmosphere contains an inert gas in addition to hydrogen containing gas.

Claim 91 is a product-by-process claim and the particular process "wherein the DWNT forming atmosphere contains an inerg gas in addition to hydrogen containing gas" has not been given patentable weight.

Regarding claim 92, Smalley et al. disclose the fullerene material predominantly comprised of double walled carbon nanotubes **(page 13 lines 20-21; and page 18 line 15)** according to claim 90 wherein the pressure of the DWNT forming atmosphere is in the range of 10 Torr to 3 atmospheres.

Claim 92 is a product-by-process claim and the particular process "wherein the pressure of the DWNT forming atmosphere is in the range of 10 Torr to 3 atmospheres" has not been given patentable weight.

Regarding claim 93, Smalley et al. disclose the fullerene material predominantly **(page 13 lines 20-21; and page 18 line 15)** comprised of double walled carbon nanotubes according to claim 91, wherein the DWNT forming atmosphere comprised is comprised essentially of a mixture of elemental hydrogen and argon gases.

Claim 93 is a product-by-process claim and the particular process "wherein the DWNT forming atmosphere comprised is comprised essentially of a mixture of elemental hydrogen and argon gases" has not been given patentable weight.

Regarding claim 94, Smalley et al. disclose the fullerene material predominantly comprised of double walled carbon nanotubes **(page 13 lines 20-21; and page 18 line 15)** according to claim 90 wherein the catalyst is comprised essentially of a mixture of iron, cobalt and nickel with sulfur.

Claim 94 is a product-by-process claim and the particular process "wherein the catalyst is comprised essentially of a mixture of iron, cobalt and nickel with sulfur" has not been given patentable weight.

Regarding claim 95, Smalley et al. disclose the fullerene material predominantly comprised of double walled carbon nanotubes **(page 13 lines 20-21; and page 18 line 15)** according to claim 92 wherein the catalyst is comprised essentially of a mixture of iron, cobalt and nickel with sulfur and wherein the DWNT forming atmosphere is comprised essentially of a mixture of elemental hydrogen and argon gases.

Claim 95 is a product-by-process claim and the particular process "wherein the catalyst is comprised essentially of a mixture of iron, cobalt and nickel with sulfur and wherein the DWNT forming atmosphere is comprised essentially of a mixture of elemental hydrogen and argon gases" has not been given patentable weight.

Regarding claim 96, Smalley et al. disclose the fullerene material predominantly comprised of double walled carbon nanotubes **(page 13 lines 20-21; and page 18 line 15)** according to claim 90 wherein the catalyst mixture is comprised of 27% iron, 14% cobalt, 51% nickel and 8% sulfur, by weight.

Claim 96 is a product-by-process claim and the particular process "wherein the catalyst mixture is comprised of 27% iron, 14% cobalt, 51% nickel and 8% sulfur, by weight" has not been given patentable weight.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 85-89 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bell et al. U.S. Patent 5,498,925 in view of Smalley et al. WO 00/17102 and Lee et al. U.S. Patent 6,420,827.

Regarding claim 85, Bell et al. teaches a field emission device **(abstract)** comprising: a cathode **(Fig. 7 cathode means ref. 73)** having an electron-emissive material **(ref. 75)** and an anode **(conductive layer ref. 22)** disposed to receive electrons emitted from the electron-emissive cathode, but fails to teach the electron-emissive material having a surface consisting of a pluralityof nanotubes with a controlled number of grapheme layers wherein each of the plurality of emissive elements is generally a double walled nanotube. Smalley et al. in the analogous art teaches the electron-emissive material having a surface consisting of a pluralityof nanotubes with a controlled number of grapheme layers wherein each of the plurality of emissive elements is generally a double walled nanotube **(page 13 lines 20-21; and page 18 line 15; page 16 lines 11 and 22-23)**. Additionally, Smalley et al. teaches incorporation of the electron-emissive material having a surface consisting of a pluralityof nanotubes with a controlled number of grapheme layers wherein each of the plurality of emissive elements is generally a double walled nanotube to improve the emission of electrons for field emitters for electronic applications **(page 16 lines 22-23)**.

Consequently it would have been obvious to a person having ordinary skill in the art at the time the invention was made to have the electron-emissive material having a surface consisting of a plurality of nanotubes with a controlled number of grapheme layers wherein each of the plurality of emissive elements is generally a double walled nanotube in the field emission device of Bell et al., since such a modification would improve the emission of electrons for field emitters for electronic applications as taught by Smalley et al.

Regarding claim 85, Bell et al. and Smalley et al. teach all the limitations of the claim 85, but fail to teach electron-emissive material uniformly distributed over the surface. Lee et al. in the analogous art teaches electron-emissive material uniformly distributed over the surface **(col. 7 lines 1-5)**. Additionally, Lee et al. teaches incorporation of such an electron-emissive material uniformly distributed over the surface to improve high resolution of the device **(col. 7 lines 5-6)**.

Consequently it would have been obvious to a person having ordinary skill in the art at the time the invention was made to use an electron-emissive material uniformly distributed over the surface in the cathode of Bell et al. and Smalley et al., since such a modification would improve high resolution of the device as taught by Lee et al.

Regarding claim 86, Bell et al. disclose a field emission device as defined in claim 85, comprising a vacuum chamber **(col. 6 lines 26-35)** for enclosing the cathode and anode.

Regarding claim 87, Bell et al. disclose a field emission device as defined in claim 86, comprising a control grid **(gate means ref. 72)** interposed between the

cathode and anode in controlling the electron flow from the cathode to the anode in response to an electric bias voltage applied to the control grid relative to the cathode.

Regarding claim 88, Bell et al. disclose a field emission device as defined in claim 87, wherein a fluorescent light emitting element **(phosphor ref. 511)** is positioned to receive electrons emitted from the cathode.

Regarding claim 89, Bell et al. disclose a field emission device as defined in claim 88, comprising a CRT wherein the anode, cathode and control grid are adapted and arranged to have electric voltage applied thereto for causing the cathode to emit electrons in response to an applied control grid voltage for controlling the light emitted by the fluorescent elements as a function of the applied grid voltage. **(power supply ref. 74; col. 7 lines 19-21).** The applied voltages are intended use. The examiner notes that with greater grid voltage one will get more electrons and therefore greater light emitted.

Allowable Subject Matter

Claim 67 is allowed.

Claims 70, 73-79 and 82-84 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding claim 67, the following is an examiner's statement of reasons for allowance: The prior art of record neither shows nor suggests a solid substance

including the combination of all the limitations as set forth in claim 67, and specifically comprised by more than one half by weight of hollow carbon nanotubes having walls consisting essentially of two layers of carbon atoms. could not be found elsewhere in prior art.

Regarding claim 70, the following is an examiner's statement of reasons for allowance: The prior art of record neither shows nor suggests an electron-emissive materil of claim 68 including the combination of all the limitations as set forth in claim 70, and specifically and nanotubes,other than double wall nanotubes which is less than 5 walled could not be found elsewhere in prior art.

Regarding claims 73 and 74, claims 73 and 74 are allowed for the reasons given in claim 70, because of their dependency status on claim 70.

Regarding claim 75, the following is an examiner's statement of reasons for allowance: The prior art of record neither shows nor suggests an electron-emissive material including the combination of all the limitations as set forth in claim 75, and specifically wherein each of the nanotubes have a lattice spacing of 0.35-0.45 nm could not be found elsewhere in prior art.

Regarding claim 76, the following is an examiner's statement of reasons for allowance: The prior art of record neither shows nor suggests an electron-emissive material including the combination of all the limitations as set forth in claim 76, and specifically wherein end cap of the double wall nanotubes with double layer curvature generates greater electric field strength than a single curvature, graphitic sheet, edge or ridge emitter could not be found elsewhere in prior art.

Regarding claim 77, claim 77 is allowed for the reasons given in claim 76, because of its dependency status on claim 76.

Regarding claim 78, the following is an examiner's statement of reasons for allowance: The prior art of record neither shows nor suggests an electron-emissive material including the combination of all the limitations as set forth in claim 78, and specifically wherein the double wall nanotubes have a diameter greater than 1.2 nm could not be found elsewhere in prior art.

Regarding claim 79, claim 79 is allowed for the reasons given in claim 78, because of its dependency status on claim 78.

Regarding claim 82, the following is an examiner's statement of reasons for allowance: The prior art of record neither shows nor suggests an electron-emissive material including the combination of all the limitations as set forth in claim 82, and specifically wherein the double wall nanotubes emit an electron at an average electric field of less than 10 V/micron could not be found elsewhere in prior art.

Regarding claim 83 and 84, claim 83 and 84 are allowed for the reasons given in claim 82, because of its dependency status on claim 82.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Kambe et al. U.S. Patent 6,045,769 discloses a Process for Carbon Production. The examiner notes that this reference was mentioned in the IDS. The examiner notes that the Kambe et al. process can be used to make Multiwalled

nanotubes (col. 3 line 10 and col. 11 lines 13-24) and perhaps even DWNT, but there is no indication that the process makes a fullerene material predominantly comprised of double walled carbon nanotubes.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Glenn Zimmerman whose telephone number is (571) 272-2466. The examiner can normally be reached on M-W 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimesh D. Patel can be reached on (571) 272-2457. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Glenn Zimmerman

Vip Patel
Primary Examiner
AU 2879